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## The Effects of Different Sized Granules and Particle Composition on Growth of Rainbow Trout (*Oncorhynchus mykiss*)

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### Abstract

Three feeding regimes were tested to determine their effects on growth, survival, and feed conversion in rainbow trout alevins for 60 days. In the first regime, the alevins were fed a starter feed consisting of 800 micron particles for the first 15-day period. For the following 15-day period, the alevins were given a starter feed consisting of 1200 micron particles. For the final two 15-day periods, the alevins were given feeds consisting of 1500 micron and 2 mm particles, respectively. In the second regime, feed particles in the four periods were 1200 micron, 1500 micron, 2 mm, and 3 mm granules, respectively. In the third regime, feeds contained 1500 micron, 2 mm, 3 mm, and 4 mm granules. During the first two 15-day periods, no significant differences in growth parameters were detected ( $p>0.05$ ). In the second two 15-day periods, there were significant differences in final live weight, growth, and feed conversion rates between groups ( $p<0.05$ ). Growth was lowest in the group fed the first regime. There were no significant differences between groups in survival rate ( $p>0.05$ ).

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### Introduction

Feeding rate, feeding frequency, particle size, and feed delivery methods affect growth, feed conversion rates, and uniformity of size among pond-cultured fish (Akyurt, 1989; Bolliet *et al.*, 2001). Therefore, feeding practices should be adapted to the aquaculture system. Particle size in feeds should start small and gradually increase as the fish grow (Bolliet *et al.*, 2001; Hardy 2002). However, until recently, pellets smaller than 2.0 mm were unavailable. Now that pellets of <1 mm are available, farmers can adapt the size and particle composition of feeds to the fish, obtaining better food consumption and growth.

The aim of this study was to determine the effects of feeds of different particle sizes on weight gain, specific growth rate, feed conversion ratio, and survival rate in a 60-day trial period.

### Materials and Methods

The experiment was carried out in nine 4 x 3 x 2 m earthen ponds at the Fisheries Department of the Agricultural Faculty at Ataturk University for 60 days. Aerated well water with a constant flow of 1.5 l/min,  $9\pm1^{\circ}\text{C}$ , 9 ppm dissolved oxygen, 7.8 pH, and 102 mg  $\text{CaCO}_3$  total hardness was used throughout the experiment. Each pond was randomly stocked with 7500 trout fingerlings ( $2.75\pm0.4$  g).

Feeds included starter granules of 0.8, 1.2, and 1.5 mm diameter and grower feeds of 2, 3, and 4 mm diameter (Hardy, 2002). The feeds contained 52% protein, 14% fat, 8% moisture, and 4645 kcal/kg total energy. Fish were fed to satiation three times a day (at 09:00, 12:30, 16:00). Fish were weighed biweekly and feed amounts were adjusted based on feeding tables by Yanik *et al.* (2003). The granule sizes were increased as the fish grew. In the first regime, fingerlings were fed granules of 800 microns in the first two weeks, 1200 microns in the second two weeks, 1500 microns in the third two weeks, and 2 mm in the final two weeks. In the second feeding regime, fish were successively given granules of 1200 microns, 1500 microns, 2 mm, and 3 mm. In the third regime, fish successively received granules of 1500 microns, 2 mm, 3 mm, and 4 mm. Treatments were conducted in three replicates for 60 days.

Weight gain, specific growth rate, feed conversion rate, and survival were determined throughout the experiment (Fowler, 1991; Yanik and Aras, 1996). Data were checked for normal distributions with normality plots prior to one-way analysis of variance (ANOVA). Duncan's multiple range test was used to determine significant differences among means at a level of  $\alpha = 0.05$  (Duncan, 1971).

### Results

By the end of the experiment, growth was significantly lower and feed conversion significantly higher in fish fed the first regime (Table 1). There were no significant differences in weight gains, specific growth rates, or feed conversion rates during the first 30 days (Fig. 1).

### Discussion

Weight gains in fish fed regimes 2 and 3 and survival rates were significantly higher than those reported by Yanik and Aras (1999) and Yanik *et al.* (2003). Our findings suggest that finer particles are not necessarily an advantage in trout fingerling culture. These results differ from those obtained by Fowler and Burrows (1971) who suggested that trout weighting 0.5-0.9 g, 0.9-2.3 g, 2.3-4.5 g, and 4.5-9.1 g should be fed particles of 0.8 mm, 1.1 mm, 1.6 mm, and 2.3 mm, respectively. Aras *et al.* (2000) suggested that 7-cm trout alevins can be fed granules of 1.6 mm. Thus, our results suggest that granule size as well as diet composition should be considered when establishing feeding protocols for trout alevin cultures.

Table 1. Growth and survival rates of fry of freshwater rainbow trout fed different starter and grower feeds for 60 days.

	<i>Feed regime</i>		
	<i>I</i>	<i>II</i>	<i>III</i>
Size of granules	800 $\mu$ , 1200 $\mu$ , 1500 $\mu$ , 2 mm	1200 $\mu$ , 1500 $\mu$ , 2 mm, 3 mm	1500 $\mu$ , 2 mm, 3 mm, 4 mm
Initial wt (g)	2.83 $\pm$ 0.04 <sup>a</sup>	2.67 $\pm$ 0.05 <sup>a</sup>	2.82 $\pm$ 0.14 <sup>a</sup>
Final wt (g)	14.15 $\pm$ 0.04 <sup>c</sup>	16.18 $\pm$ 0.17 <sup>b</sup>	17.33 $\pm$ 0.10 <sup>a</sup>
Wt gain (%)	405.61 $\pm$ 16.84 <sup>b</sup>	507.17 $\pm$ 4.91 <sup>a</sup>	515.40 $\pm$ 34.37 <sup>a</sup>
Specific growth rate (%)	18.92 $\pm$ 0.21 <sup>b</sup>	24.18 $\pm$ 0.40 <sup>a</sup>	24.53 $\pm$ 0.76 <sup>a</sup>
Feed conversion ratio	0.96 $\pm$ 0.01 <sup>b</sup>	0.83 $\pm$ 0.01 <sup>a</sup>	0.83 $\pm$ 0.01 <sup>a</sup>
Survival (%)	99.92 <sup>a</sup>	100 <sup>a</sup>	99.92 <sup>a</sup>

Values within a row with different letters are significantly different ( $p < 0.05$ ).

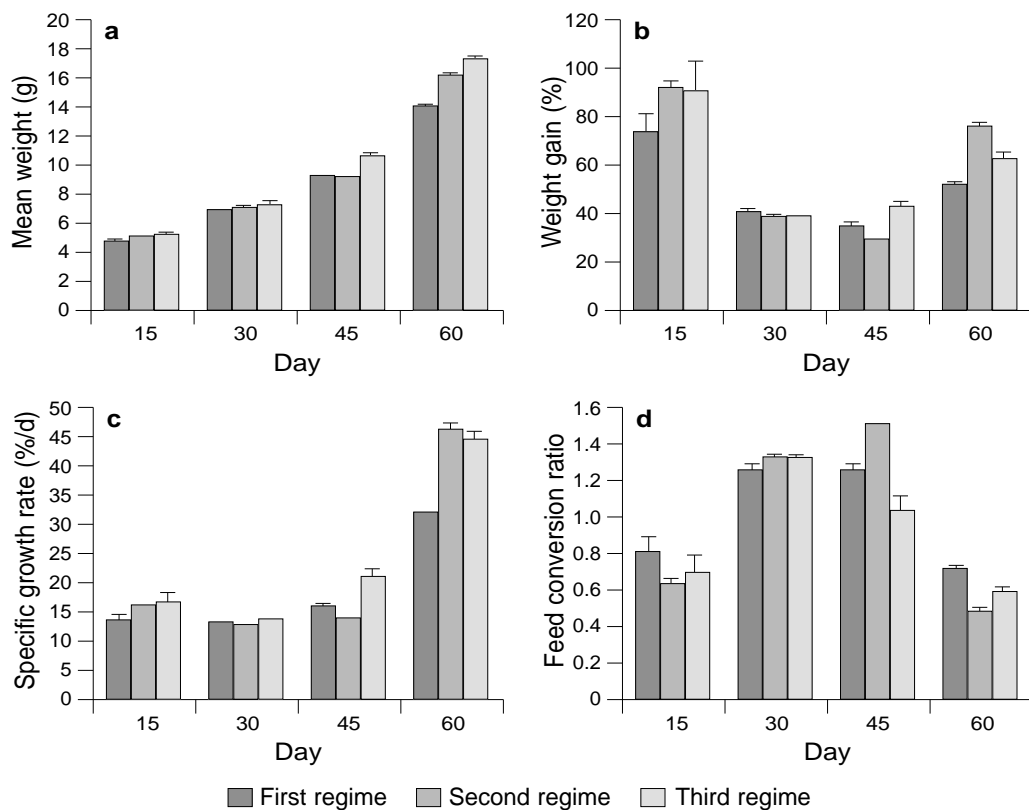


Fig. 1. Effects of different feeding regimes on (a) weight, (b) weight gain, (c) specific growth rate, and (d) feed conversion ratio of rainbow trout fingerlings.

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